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Real-time baseline coagulation profiles using ROTEM in patients undergoing liver transplantation

Paul DelPrato, Uzung Yoon, MD*

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Introduction & Objectives

- Rotational thromboelastometry (ROTEM) is a real-time monitoring system of whole blood hemostasis
- Measurements acquired can be considered superior to lab-based tests such as aPTT and PT/INR (Theusinger, et al. 2013)
- Long-term objective is to increase utilization of ROTEM in complex surgical procedures
  - Currently used at Jefferson in liver-transplant procedures

Source: Instrumentation Laboratory

Source: Williams (2016)

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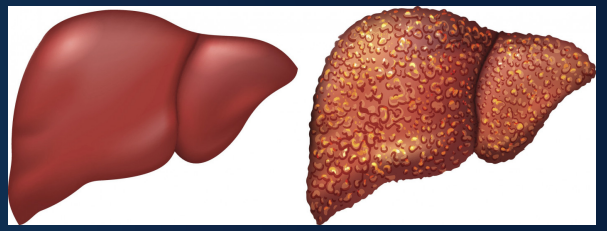
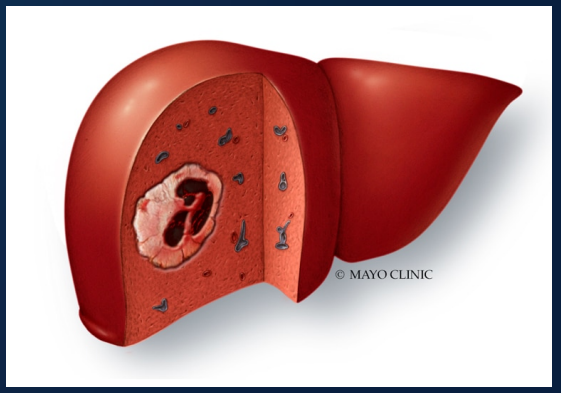
Research Question & Hypothesis

- Research Question
  - In liver transplant patients, what are ***baseline coagulation profiles*** – using basic ROTEM measurements – to expect based on certain transplant procedure etiologies?
- Hypothesis
  - More coagulopathy – increased ROTEM clotting time, etc. – will be observed in patients with whole liver transplant etiologies (e.g. alcoholic cirrhosis) than a focal hepatocellular carcinoma transplant etiology





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Brief review of methods

Data: ROTEM coagulation measurements at Jefferson have been acquired from approximately 400 liver transplant patients since 2013

PICO

Population - liver transplant patients at Jefferson, 2013-present

Intervention - ROTEM data acquired during transplant procedure

Comparator - patient groups based on hepatocellular carcinoma vs. whole hepatocellular pathology etiology

Other –

- Outcome measures (complete data in 221 patients) –
  - **ROTEM coagulation measurements** e.g. clotting time, clot formation time
  - **MELD scores** (uses serum bilirubin, INR, serum creatinine from EPIC)
- Analysis – paired t-test comparing patient groups, correlations run comparing continuous measurement variables

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Prior to reporting coagulation profiles of patients from our database, we wanted to test levels of correspondence between our ROTEM measurements with a proven indicator of risk…

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MELD scores in liver transplants

- MELD score – Model for End-stage Liver Disease -- is predictive of post-surgery mortality
- Computed from EPIC chart review of patients in database using labs immediately prior to surgery:
  1. Serum creatinine
  2. INR
  3. Serum bilirubin
- These values will be included in patient coagulation profiles

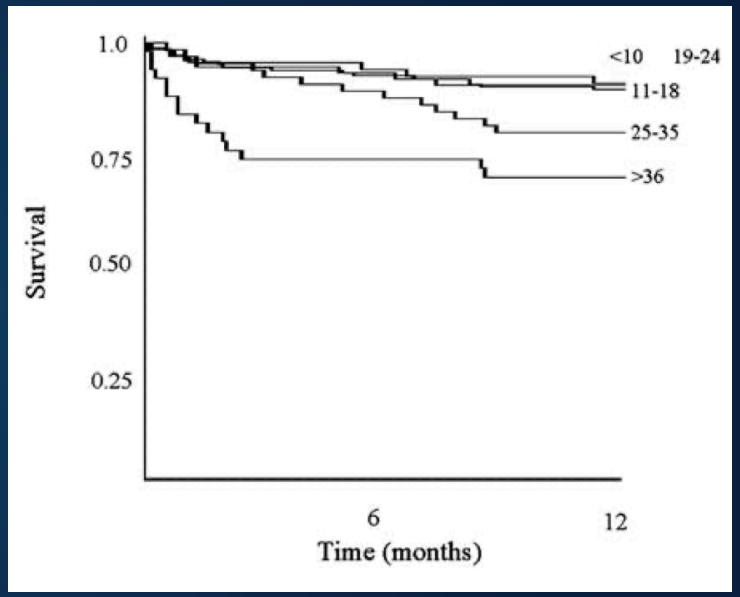

Figure 1 of Saab et al. (2003), *Liver transplantation.* 1 year Cox survival estimate.

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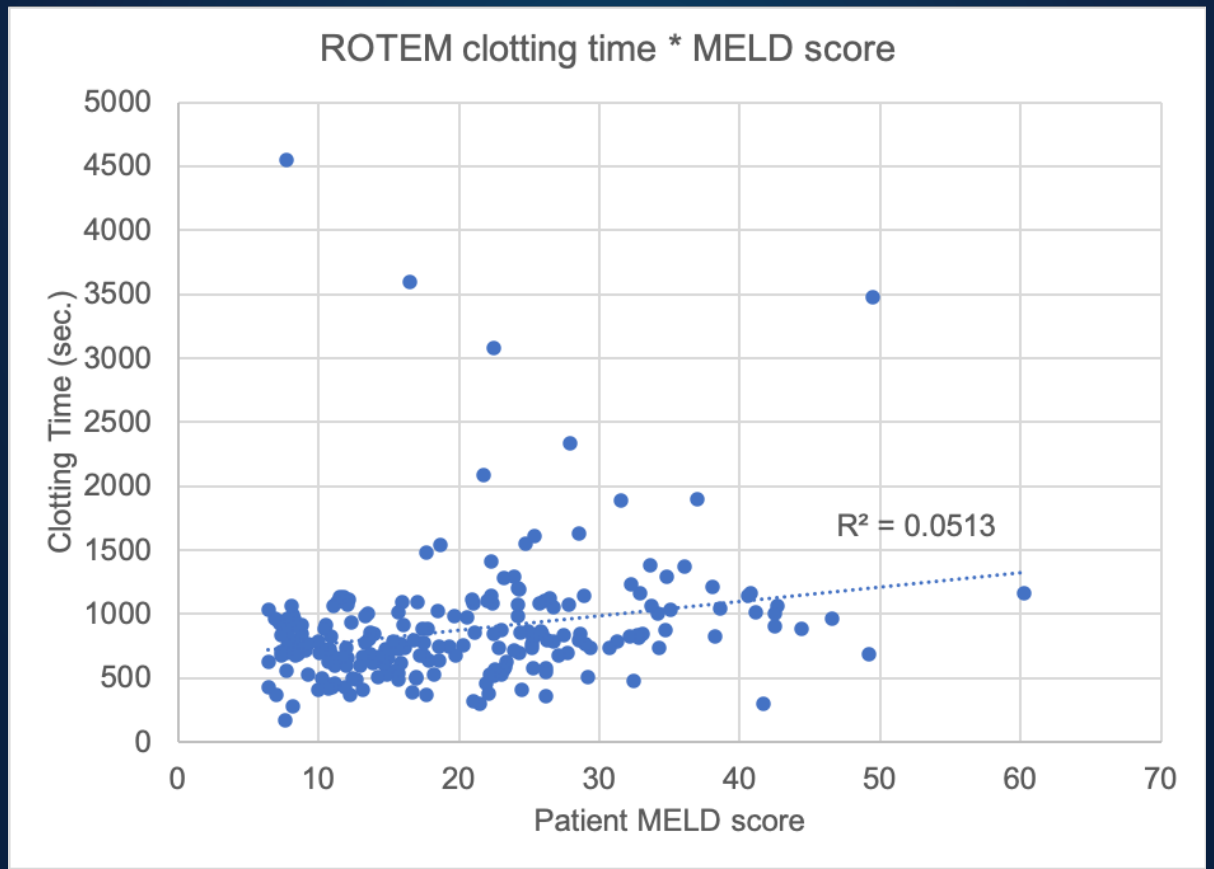
Exploratory population-level analysis

- Question: Do patient MELD scores correlate with baseline ROTEM clotting times?



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Results, HCC vs. non-HCC

Group	N	Clotting Time (Mean)	Clotting Time (StDev)	MELD (mean)	MELD (StDev)
HCC	75	813.6	507.4	12.8	6.1
Other	146	944.0	495.4	23.7	9.8

For both ROTEM CT scores and MELD scores, the non-cancer patient group had values trending in the direction suggesting *more* coagulopathy

Large levels of variance are present in these variables

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Obstacles

- Data retention:
  - 400 patients in total database
  - 283 have a baseline NATEM measurement (71%)
  - 221 have baseline NATEM + MELD score (55% of grand total)

- Our initial hypothesis comparison groups – hepatocellular carcinoma (N=87)* vs. non-cancer (N=134)* – suffer from unbalanced sample sizes

* - Distinct patients with baseline natem values and adjusted MELD scores

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Conclusions

- From this project:
  - Further analysis is needed to investigate coagulopathy measures in HCC compared to other transplants
- Overall, our overarching aim is to *provide more resources for ROTEM users* to increase overall utilization in ORs
- Providing baseline profiles for liver transplant patients has utility *even without* hypothesis testing

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Future directions

- **Outlier handling** to reduce population variance
  - Is this methodologically sound while studying liver pathology?
- Assess coagulation measures across **other demographic variables**
  - Age, Sex, Race/Ethnicity, other disease processes

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